

ADDITIONAL FEES:

No additional fees are believed required; however, should it be determined that a fee is due, authorization is hereby given to charge any such fee to our Deposit Account No. 01-0268.

REMARKS

In the last Office Action, claim 18 was objected to as being identical in scope to claim 15. Claims 21 and 23 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner stated that the claims lack sufficient antecedent basis for the limitation "active matrix liquid crystal cell". Claims 1, 2, 5, 6, 10-16 and 18-20 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,191,410 to Johnson ("Johnson"). Claims 4 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Johnson, and claims 3, 7 and 8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Johnson in view of U.S. Patent No. 5,869,701 to Young ("Young").

By the present response, claims 13 and 18 have been canceled and claims 21 and 23 have been amended to overcome the Examiner's objections and indefiniteness rejections. Independent claims 1, 6 and 11 have been amended to further distinguish from the prior art by reciting a light guiding plate having parallel opposed main surfaces. Dependent claims

14, 15, 17 and 19 have been amended to depend upon independent claim 11 in view of the cancellation of dependent claim 13.

Applicants respectfully submit that amended independent claims 1, 6 and 11 patentably distinguish over the prior art of record.

The present invention relates to a fingerprint reading device and a fingerprint reading method. As recited by amended independent device claims 1 and 11, the inventive fingerprint reading device comprises a liquid crystal cell, an illumination source for projecting a light from the rear surface to the front surface of the liquid crystal cell, a flat light guiding plate having parallel opposed main faces disposed on the front surface of the liquid crystal cell for transmitting the light projected from the rear surface of the liquid crystal cell and deflecting light entering from the front surface toward a side end surface of the light guiding plate, light receiving means on the side end surface of the light guiding plate for receiving the deflected light exiting from the side end surface of the light guiding plate, and a drive circuit for driving the liquid crystal cell to pinpoint-irradiate a fingerprint in contact with the light guiding plate by pinpointing with the light emitted from the illumination source and causing the light receiving means to pinpoint-receive the light reflected by the fingerprint to

thereby obtain an image of the fingerprint. Independent method claim 11 includes similar language.

Accordingly, each of amended independent claims 1, 6 and 11 requires a flat light guiding plate having parallel opposed main surfaces disposed on a front surface of a liquid crystal cell.

In the embodiment illustrated in Figs. 1(a) and 1(b) of the application drawings, the fingerprint reading device 10 has a light guiding plate 12 comprised of a flat plate having parallel opposed main surfaces disposed above the front or viewing surface of an active matrix liquid crystal cell 11. A light receiving device 13 is mounted flush with an end surface of the light guiding plate 12, and an illumination source 14 is disposed on or below the rear surface of the liquid crystal cell 11.

The light guiding plate 12 transmits light emitted from the illumination device 14 toward the front surface side but does not transmit the light coming from the front surface side toward the rear surface side and deflects or guides this flux of light in a plane-direction toward the light receiving device 13 at one side end surface. The light receiving device 13 is constructed of a lens array 15 and a light receiving element 16 such as a photodiode.

As shown in Fig. 2(a) of the drawings, a source electrode 41 of a transistor serving as an active element 26

of the liquid crystal display is connected to a transparent electrode 25. A gate electrode 42 is connected to a scan line 51. A drain electrode 43 is connected to a signal line 52. A plurality of signal lines 52 are arranged so that the drain electrodes 43 of the respective transistors are connected in series in the X-axis direction. The signal lines 52 are connected to an X-axis driver 53. Further, a plurality of scan lines 51 are arranged so that the gate electrodes 42 of the respective transistors are connected in series in the Y-axis direction. The respective scan lines 51 are connected to the Y-axis driver 54.

Thus, the transparent electrodes 25 are actively addressed via the respective active elements 26. The transparent electrodes 25 are connected to x signal lines 52 connected to an X-axis driver 53 and to y scan lines 51 connected to a Y-axis driver 54, and have addresses  $(1, 1) - (x, y)$ .

When detecting a fingerprint, the X-axis driver 53 first selects a predetermined signal line 52 and a predetermined voltage is applied to a gate electrode 42, in which state a voltage is applied to the active elements 26 arranged in one row through the scan lines 51. The active elements 26, which have been selected after the predetermined voltage has been applied to the gate electrodes 42, are thereby selected one by one in sequence. The liquid crystal

layer 24 in an area facing the selected transparent electrodes 25 for one pixel is oriented, and transmits the light emitted from the illumination device 14.

Fig. 2(b) shows a state at that time. More specifically, only the selected transparent electrodes 25 for one pixel become transparent, and a finger 60 is thereby illuminated with the light from the illumination device 14. On the other hand, the light reflected by the finger 60 is deflected at a boundary on the rear surface side of the light guiding plate 12, and guided in the plane-direction. The thus guided light is received by the light receiving device 13 provided on one side surface in the side-by-side relation with the light guiding plate 12. This operation is executed with respect to all the pixels, whereby an image of the fingerprint can be obtained.

The inventive fingerprint reading device can detect a fingerprint comparatively easily by use of the active matrix liquid crystal cell 11 and the light guiding plate 12. Further, the fingerprint reading device 10 has a structure similar to that of a liquid crystal display device and can be relatively simply manufactured at a low cost. The fingerprint reading device 10 can also be easily incorporated together with a liquid crystal panel into an electronic apparatus.

In accordance with the present invention, an image of a fingerprint can be read by use of an active matrix liquid

crystal cell and a light guiding plate and the device may be easily incorporated into a liquid crystal display device.

The prior art of record fails to disclose or suggest the use of a flat light guiding plate.

A finding of anticipation requires the disclosure, by a single reference, of all claimed subject matter. In the absence of the disclosure by Johnson of a flat light guiding plate having parallel opposed main surfaces as recited by amended independent claims 1, 6 and 11, and the additional limitations thereto recited in the dependent claims, anticipation cannot be found. See, e.g., Continental Can Co. USA v. Monsanto Co., 20 USPQ2d 1746, 1748 (Fed. Cir. 1991) ("When more than one reference is required to establish unpatentability of the claimed invention anticipation under § 102 can not be found"); and W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) ("Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration").

Although Johnson discloses a fingerprint reading device having a light guiding member disposed on a liquid crystal matrix, the light guiding member is a wedge-shaped prism rather than a flat plate having parallel opposing surfaces. The prism is disposed on a light emitting device for guiding light from a finger to a light receiving device.

Thus, the fingerprint reading device disclosed by Johnson does not anticipate amended independent claims 1, 6 and 11 because it fails to utilize a flat light guiding plate having parallel opposed main surfaces.

More specifically, as shown in Figs. 1 and 2 of Johnson, a wedge-shaped prism 1 is disposed on a surface-emitting laser 2 and a photoelectric sensor 3 is disposed at a side surface of the prism 1. In order to read a fingerprint, the finger 4 is pressed to the top surface 5 of prism.

The wedge angle 13 between the top surface 5 of the prism and the bottom surface of the prism determines the angle of incidence 14 of each sub-beam emitted by the surface-emitting laser 2. The angle of incidence of the sub-beams is selected so that the points where the fingerprint ridges 15 of the subject contact the prism top surface will not internally reflect the laser radiation, and the points corresponding to the fingerprint valleys 16 of the subject where the finger of the subject not in contact with the top surface of the prism will reflect the laser radiation.

The various drawbacks associated with the use of a prism in a fingerprint reading device as disclosed by Johnson include the increased thickness of the device caused by the prism, the increased cost of the device, and uneven resolution caused by the prism.

In particular, a fingerprint read by the Johnson device will be partly out of focus and thus unreadable. Since light spreads as it travels, the uneven distances traveled by light in the prism results in distortion. In particular, the distance traveled by light differs in different portions of the fingerprint being read by the Johnson device due to use of the prism.

Contrastingly, the inventive fingerprint reading device ensures that light travels uniformly through the flat light guiding plate so that the resolution of a read fingerprint device does not depend upon the portion of the fingerprint.

Although the Fig. 3 embodiment of Johnson includes a radiation source 21 and a pixilated LCD 22, the prism is disposed over the LCD 22 in the same manner as described above. Each pixel of the LCD is activated in a desired sequence to transmit the illuminating radiation into the bottom surface of the prism and illuminate a corresponding point on the top contact surface of the prism.

Accordingly, in each disclosed embodiment Johnson utilizes a wedge-shaped prism to direct light to one end surface thereof for fingerprint detection.

Contrastingly, the claimed invention utilizes a flat light guiding plate having parallel opposed main surfaces disposed on a front surface of a liquid crystal device.

For the foregoing reasons, applicants respectfully submit that amended independent claims 1, 6 and 11 and dependent claims 2, 5, 6, 10, 12, 14, 16, 18 and 20 patentably distinguish over Johnson and that the anticipatory rejection should be withdrawn.

Young does not cure the foregoing defects and does not suggest modifying Johnson to provide a flat light guiding plate having parallel opposed main faces. Young discloses a touch sensitive input device comprised of a plurality of individually operable touch-sensitive elements having first and second overlapping and spaced conductive layers 12, 15 with the second conductive layer being displaceable towards the first conductive layer in response to a touch input. The device is fabricated by forming a thin film multi-layer structure on a support, comprising the first and second conductive layers with an insulating layer 16 therebetween and in which the second conductive layer is provided with apertures at predetermined regions, and subjecting the structure to an etching process which removes insulating material between the conductive layers at the apertured regions via the apertures to form gaps 19. This leaves the second conductive layer 15 at each region supported in spaced relationship to the first conductive layer by the insulating layer around the periphery of the region. The device of Young may be used as a keypad or arranged in a row and column matrix

as a graphics tablet or display overlay operated with a stylus or integrated with a liquid crystal display panel.

A rejection based upon obviousness under 35 U.S.C. §103(a) must establish the obviousness of each limitation of a rejected claim. In the context of a purportedly obvious modification, "the mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992). Young does not suggest modifying Johnson to provide a flat light guiding plate.

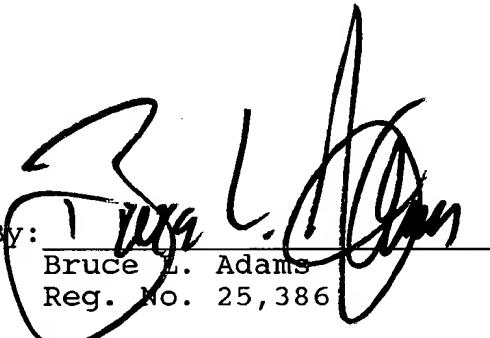
For the foregoing reasons, applicants respectfully submit that claims 3, 4, 7, 8 and 9 patentably distinguish over Johnson, taken alone, or in combination with Young, and that the rejection under 35 U.S.C. §103(a) should be withdrawn.

In view of the foregoing amendments and discussion, the application is now believed to be in condition for

allowance. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

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MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: MS NON-FEE AMENDMENT, COMMISSIONER FOR PATENTS, P.O. Box 1450, Alexandria, VA 22313-1450, on the date indicated below.

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August 7, 2003

Date